

***INTER-AMERICAN DEVELOPMENT BANK***



**Nicaragua**

***TIPITAPA POWER PLANT PROJECT  
(NI-0103)***

***ENVIRONMENTAL AND SOCIAL IMPACT REPORT***

***AUGUST 1998***

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# ENVIRONMENTAL AND SOCIAL IMPACT REPORT

## TIPITAPA POWER PLANT

NI-0103

Country;	Nicaragua
Project:	Tipitapa Power Plant
Operation Number:	NI-0103
Borrower:	Coastal Power Nicaragua, Ltd.
Sponsor:	Coastal Power Company
Total Project Cost:	US\$ 43.00 million
Bank participation:	A-Loan: US\$ 10.75 million B-Loan: US\$ 19.25 million
Date of Approval of ESIB:	December 5, 1997
Project team:	Alberto Cogut (Team leader), PRI Nicolás Mariscal, PRI Robert Montgomery, PRI Pilar Suescum, LEG

### 1. INTRODUCTION

- 1.1 With 348 MW of available generating capacity and an estimated peak demand of 381 MW for 1998, Nicaragua has to import energy (when available) from neighboring countries. To satisfy the electric energy demand and to have a 20% reserve capacity, the local utility, *Empresa Nicaragüense de Electricidad* (ENEL), needs to add approximately 100 MW by 1999. With no resources to undertake any new investment in generation, the company has started the process of private sector participation in generation (an independent power producer currently operates a 30-MW thermal plant under a 7-year PPA).
- 1.2 The current expansion plan contemplates the addition of 50 MW by 1999 (this project), the rehabilitation of the *Momotombo* geothermal field (to recover the 70 MW of original design from the present 15 MW) within 36 months, and the signing of firm-capacity contracts with neighboring countries.
- 1.3 The Tipitapa Power Plant project (APlant≡ or AProject≡) resulted from an international competitive bidding launched by ENEL. Coastal Power Corporation (CPC) proposed the lowest tariff, 5.75 ¢/kWh, which represents a landmark in energy prices for the region. The project is the first concession awarded in the energy sector since the enactment of new legislation for the sector (*Ley de la Industria Eléctrica*) in October 1997. The plant will sell its output to ENEL under a 15-year Power Purchase Agreement (PPA). ENEL requires the

project to deliver energy to the Tipitapa substation, located 19 kilometers east of Managua.

- 1.4 The Tipitapa Power Company (TPC or the Company) is the special purpose company created to undertake the project. A fixed-price engineering, procurement and construction (EPC) contract based on a defined scope of supply and technical requirements has been signed with Wartsila NSD. Construction supervision is provided by the construction group of The Coastal Corporation (CPC=s parent company), while operation, maintenance and administration of the project will be contracted with Coastal Technology Inc., an affiliate of CPC with experience in other projects using similar technology in Latin America (El Salvador and Dominican Republic).
- 1.5 The Inter-American Development Bank is evaluating providing project financing for only the operation phase of the Project.

## 2. PROJECT DESCRIPTION

### A. Location

- 2.1 Since ENEL required, as part of the PPA, the project to deliver energy to the Tipitapa substation, the Tipitapa Power Company acquired 4.1 hectares of private undeveloped land for the plant site located adjacent to the Tipitapa substation, thus minimizing the impacts associated with new transmission lines. The plant site, previously used for agricultural purposes, is located approximately 2.5 km south of the town of Tipitapa and 19 km east of Managua, along the east side of the Old Highway to Tipitapa and adjacent to ENEL=s 138 kV Tipitapa substation.
- 2.2 The community of *San Rafael*, approximately 0.5 km south of the site, is the closest residential area. Open fields, agricultural areas and some scattered houses can be found to the north and east of the site. One half kilometers to the west is located the recreational area of *El Trapiche*. The closest industrial facility is located 4.5 km northeast. The area is relatively flat, ranging in elevation from 56 to 60 meters above sea level (msl). Although there are various heterogeneous activities taking place in the surroundings, local authorities are proposing to define various portions of the area for industrial use. In terms of ambient air quality, the general area of the site is considered unpolluted since no major air emission sources are present.

### B. Facilities

- 2.3 The Tipitapa power plant will consist of a nominal 50 MW, diesel engine electric generating power plant and other facilities (e.g., fuel delivery and storage, cooling system, etc.) required for the operation and maintenance of the plant. The project PPA requirements defined the generating technology to be medium-speed diesel units, which were offered by all participants

in the bidding process. The plant will consist of five model Wartsila 18V38 diesel engine generators, which were selected by CPC due to low maintenance requirements and low NO<sub>x</sub> combustion design.

- 2.4 The diesel engine generators will burn primarily Bunker C (No. 6 fuel oil). The engines will also be capable of firing on No.2 fuel oil as backup. The No. 6 fuel oil quality will be similar to that used in other diesel power plants, with a maximum sulfur content of 3 percent by weight and a maximum ash content of 0.2 percent by weight.
- 2.5 The No. 6 fuel oil will be stored in two 4.2 million-liter aboveground steel storage tanks, which will store the equivalent of a 30-day supply of fuel (calculated at a theoretical 100% load factor). At 88% capacity, approximately 97 million liters per year of No. 6 fuel oil will be required. The secondary No. 2 fuel will be stored in a 757,000 liter, above ground, steel tank. All tanks will be surrounded by spill containment walls.
- 2.6 Fuel will be supplied to the Project pursuant a 15-year fuel supply agreement (FSA) entered between CPC and Esso Standard Oil S.A. (ESSO). The fuel will be delivered by an existing pipeline from the ESSO terminal in Puerto Sandino to a ESSO terminal near Managua, and subsequently by truck to the plant. No improvements to existing roads or the port facilities are required associated with the Tipitapa project. The Tipitapa plant will have facilities for truck unloading and a platform scale.
- 2.7 Exhaust gases will be released through a group of five separate 32-meter stacks, furnished with their respective mufflers. The Model 18V38 diesel engines to be used in the plant incorporate the latest technology in low NO<sub>x</sub> combustion design. The air emissions of sulfur dioxide (SO<sub>2</sub>), nitrogen oxides (NO<sub>x</sub>), and particulate matter (PM ) will comply with the World Bank guidelines for new thermal power plants (Pollution Prevention Handbook, September, 1997).
- 2.8 Water for the plant will be supplied from two new on-site ground water wells. The estimated average water usage is approximately 2,270 liters per minute (lpm), consisting of primarily cooling water (2,200 lpm) with limited quantities for potable water, boiler water, equipment washing, and fire protection. The wells will be drilled to an overall depth of approximately 120 meters below ground surface. To minimize the plants water requirements, a system of five cooling towers will allow the recirculation of cooling water. Ground water will also be used for domestic purposes and fire fighting. Water treatment will be provided for domestic use (filtration, chlorination, and storage tank) and for boiler usage (hardness reduction). The fire fighting system will include a water storage tank, hydrant pumps, portable fire extinguishers and alarm systems.
- 2.9 Waste water from the facility will be primarily cooling water, with very limited amounts of sanitary and industrial waste water and storm water runoff. Industrial waste water will be treated (sedimentation, neutralization and other chemical treatments as necessary) prior to

discharge. Domestic waste water will be disposed in an on-site septic system. The waste water discharge from the plant (approximately average of 511 to 984 lpm) will be routed through a 1,020 meter pipeline, constructed along the east side of the Old Highway to Tipitapa, and discharged into the *La Mocuana* River. Waste water discharges will comply with applicable Nicaraguan Ministry of Natural Resources and the Environment (*Ministerio del Ambiente y Recursos Naturales*, MARENA) requirements and the World Bank guidelines for thermal power plants (Pollution Prevention Handbook, September 1997).

- 2.10 Storm water runoff which may be contaminated (e.g., from the fuel unloading, fuel storage, and other equipment areas) will be collected and routed to an oil-water separator unit. Oil will be removed and the resultant water (maximum oil and grease concentration of 20 mg/l) will be discharged. Drainage from the oil storage areas will have valves to appropriately isolate and control the flow of run off water to the separator unit. The collected waste oil and grease will be stored temporarily in an on-site tank prior to off-site disposal or recycling.
- 2.11 Other facilities associated with the power plant include: a lubricating oil storage area (25,000 liter tank, a cooling system (five small mechanical cooling towers), compressor systems, a chemical storage area, a waste storage area, laboratory, offices and a security system.
- 2.12 A high-voltage transformer and electric energy switchyard for the interconnection with ENEL's Tipitapa substation will be located within the project site. The switchyard equipment will be installed with appropriate protective relays, disconnect switches, aluminum bus and grounding to provide for the safety of the switchyard operation. The switchyard area will be covered by gravel and surrounded by a security fence that will separate it from the other project facilities. The transformers will not use materials containing polychlorinated biphenyls (PCBs). The new transmission line interconnecting the plant and the ENEL substation will be 50 meters long.
- 2.13 An average of 150 employees will be required for the project construction, with a maximum construction work force of 300 employees. Approximately 30 employees will be required during operation.

#### **C. Schedule and Cost**

- 2.14 The PPA requires the plant to start operating by April 14, 1999. Construction started in February 1998. According to the company's schedule, construction is expected to take 11 month and to be finished by the end of 1998.
- 2.15 The total project cost is US\$ 43.0 million. Domestic construction costs total US\$ 4.1 million (including local services and purchase of construction materials).

### **3. INSTITUTIONAL AND LEGAL FRAMEWORK**

## **A. Institutional**

### **A.1 Applicable Sector**

- 1.1 The *Instituto Nicaragüense de Energía* (INE) is an autonomous entity responsible for policy formulation, planning, research and execution of activities related to the construction and operation of power facilities. However, this agency works together with MARENA (*Ministerio del Ambiente y Recursos Naturales*) in the assessment of environmental studies carried out before the construction and operation of electric power plants.
- 3.2 *Empresa Nicaragüense de Electricidad* (ENEL), Nicaragua's public generation, distribution and transmission company, is the project offtaker. ENEL does not regulate the sector, but it demands the fulfillment of the corresponding regulations. INE's *Dirección de Control Ambiental* (DCA) is in charge of establishing and monitoring the application of environmental regulations within the energy sector. DCA works in coordination with MARENA.
- 3.3 Other agencies involved are the Nicaraguan Institute of Aqueducts and Sewer Systems (*Instituto Nicaragüense de Acueductos y Alcantarillados*, INAA), which regulates groundwater extraction and grants the corresponding permits for the opening of water supply wells, and the Bureau of Land Transportation of the Department of Construction and Transportation (*Dirección General de Transporte Terrestre del Ministerio de la Construcción y Transporte*), which regulates heavy machinery and equipment transportation during the construction phase, and fuel transportation during the operation phase.

### **A.2 Environment**

- 3.4 As mentioned above, the national agency in charge of granting the environmental permit before construction is MARENA. This Ministry is also responsible for the implementation of environmental policies in Nicaragua, and takes part in the environmental controls of emissions, quality of recipient bodies, etc. MARENA and INE only have a limited number of highly qualified professionals and limited amount of available resources.

### **A.3 Health and Safety**

- 3.5 The Ministry of Health has authority over issues related to health and safety. The Ministry intervenes in events where risk is involved either due to potential health dangers or because of environmental emergencies.
- 3.6 The Republic of Nicaragua has a Bureau of Firemen (*Dirección General de Bomberos*) which reports to the Ministry of the Interior (*Ministerio de la Gobernación*) which addresses safety operating measures concerning contingencies and emergencies. This agency does not require specific documents for the operation of the Tipitapa type of power plant.



- 3.7 Since the applicable institutional authorities involved in emergency and safety have limited capabilities, in terms of available resources, private companies typically establish their own emergency/accident response facilities and systems to either completely perform or complement the available governmental operations.

#### **A.4 Local Authorities**

- 3.8 The Republic of Nicaragua is organized in Departments, with the *Alcaldía* having principal authority at the local level. Departmental delegations are responsible for environmental issues, although their duties are limited. Owing to the decentralization process that has taken place during the last years, municipalities have now greater participation, however they lack appropriate resources and therefore operating capacity. Regardless, their participation is very important since they are the recipients of potential community complaints and the first to communicate irregularities to the national authorities.
- 3.9 The *Alcaldía de Tipitapa* has a local responsibility to allow the construction of the plant, in accordance to local land uses and regulations; for example, the municipality is responsible for solid waste disposal and will authorize and charge for the services of reception and disposal of the plant's solid domestic waste.

### **B. Legal Framework**

#### **B.1 Applicable Laws**

- 3.10 The judicial and legal framework on the environment is stated in the Constitution of the Republic of Nicaragua. In recent years a series of laws and decrees that apply to the project have been approved.
- 3.11 Decree No. 261-93: *Plan de Acción Ambiental para Nicaragua* (PAA-Nic) defines the country's environmental policies and establishes the *Sistema Nacional de Gestión Ambiental* (SNGA), a decentralized entity focused on environmental issues.
- 3.12 Law No. 217: *Ley General del Medio Ambiente y los Recursos Naturales* establishes the main environmental guidelines for the Tipitapa project. Article 25 of this law requires that the Project Company obtain an Environmental Permit from MARENA before the construction and operation of the power plant. Article 26 of the Law states that an Environmental Impact Assessment (EIA) must be conducted as a prerequisite to obtain the Environmental Permit. Article 27 establishes that permits and EIA studies must be monitored by MARENA in conjunction with INE. In addition, MARENA must also consult with the corresponding municipal authorities regarding the EIA.
- 3.13 The *Ley General del Medio Ambiente y los Recursos Naturales* establishes that an

authorization for the use of water must be requested, and that it may be revoked, modified or canceled by the authorities in case of abuse of extraction. The beneficiary must use the water in an economical and efficient manner and undertake works to avoid pollution. In addition, the competent authority must establish patterns of annual volumes of maximum extraction, whose controls will be in charge of the municipalities.

- 3.14 According to Law No. 217, the *Alcaldías* must comply with the norms set by MARENA and the Ministry of Health, and they are responsible for collecting, treating and disposing nonhazardous solid waste. The Ministry of Health, together with MARENA, will issue norms for the disposal or elimination of toxic substances, which, due to their nature, may pollute the ground or water.
- 3.15 Decree No. 45-94: *Reglamento de Permiso y Evaluación de Impacto Ambiental* of 1994, establishes procedures for obtaining Environmental Permits for projects requiring an Environmental Impact Assessment (EIA) study. The decree establishes that the costs of assessment, mitigation measures, monitoring and environmental management plans must be covered by the project sponsor. MARENA may carry out inspections to verify the data submitted in the EIA. The permit may be canceled as a result of noncompliance with the requirements of preservation and protection of the environment. This would result in the interruption or closing of operations. This decree determines that the information in the EIA must be made available to the community for consideration through public consultation mechanisms.
- 3.16 Decree 9-96: states some specific points in relation to the provisions of Law No. 217, such as the people's right to be informed. As a result, instruments of environmental management must include mechanisms of public participation. MARENA must ensure that the periodical environmental quality monitoring is carried out (technical and scientific institutions may be selected for this purpose). MARENA is also responsible for controlling the accuracy and quality of the monitoring and it must determine the quality standards for each resource.
- 3.17 Decree No. 33-95: establishes the provisions for control of waste water pollution from the domestic, industrial (including specifically thermal power plants), agricultural and farming sources. MARENA is responsible for the control, supervision and application of penalties of liquid effluent disposal. Companies must notify the characteristics of their disposal and treatment facilities to MARENA. Waste water discharge limits are established for each activity, including energy generation from thermal plants. Frequency and methodology of monitoring are also established by this decree. Companies must inform MARENA, which will notify to the municipalities upon request. The decree also establishes provisions for control of pollution resulting from wastewater disposal.
- 3.18 In Nicaragua, there are no specific laws or regulations which define specifically ambient air or noise limits thermal power plants.

## **B.2 Health and Safety**

- 3.19 Apart from the above-mentioned norms, there are no other safety standards related to this project. The norms emphasize the civil and criminal liabilities that the project sponsors have in the event of an emergency. These norms also state the sponsor=s obligations to prevent, control and remedy all kinds of contingencies that may risk the population's health and safety. Government authorities are entitled to order the termination of operations if there are actions or omissions incurred by the Company.

## **B.3 Power Purchase Agreement**

- 3.20 The Power Purchase Agreement (PPA) contract for the Tipitapa power plant project requires that CPC comply with the laws, regulations and other provisions dealing with the environment of the Republic of Nicaragua; as well as to obtain the Environmental Permit and other authorizations from the competent authorities which may be necessary to obtain for the construction and the operation of the plant and, in general, for the execution of the PPA contract.

## **B.4 World Bank Guidelines**

- 3.21 The Tipitapa power plant project will comply with the World Bank guidelines for new thermal power plants (Pollution Prevention Handbook, September, 1997).

## **C. Project Compliance Status**

- 3.22 MARENA defined the specific requirements for conducting the Tipitapa Power Plant Environmental Impact Assessment (EIA). The EIA was completed and submitted to MARENA in December 1997. After submitting the EIA to MARENA, a public consultation was held in Tipitapa on January 23, 1998 in order to receive comments and input from the local affected population. A complete version of the EIA was made available to the public.
- 3.23 MARENA granted the Environmental Permit for the Tipitapa project on in February 5, 1998 (Resolution 005-98). The permit contains various covenants; for example, some specific mitigation measures (e.g., design of chemical storage area, measures to mitigate noise, design of waste water discharge structure, etc.), need to demonstrate contract for waste oil disposal, and need to confirm no impacts from ground water withdrawal and surrounding water wells. The permit requires that the Project comply with all applicable laws and is valid for 18 months.
- 3.24 On March 27, 1998, INAA granted TPC permission to perform an analysis of ground water associated with the two new on-site ground water wells. Based upon positive results of the tests, INAA issued a Groundwater Withdrawal Permit on June 8, 1998.

- 3.25 The following is the current status of permits, approvals and registrations related to environmental issues for the project:

**Nicaragua governmental agency permits, approvals and registration list  
Tipitapa Power Project**

Permit/Licence/Registration Type	Agency	Status	If pending, projected date to obtain/finalize	Responsibility
Environmental Permit	Ministerio del Ambiente y Recursos Naturales (MARENA)	approved 2/5/98		Tipitapa Power Company
Change of Use of Land	Municipality of Tipitapa	approved 2/5/98		Tipitapa Power Company
Operations License	Instituto Nicaraguense de Energia (INE)	Ministerial issued 7/31/98		Tipitapa Power Company
Facility Inspection Approval	Direccion General de Bomberos -Ministerio de Gobernacion	pending	prior to commercial operation	Tipitapa Power Company
Groundwater Well Drilling	Instituto Nacional de Acueductos y Alcantarillados (INAA)	approved 3/27/98		Tipitapa Power Company
Groundwater Withdrawal Permit	Instituto Nacional de Acueductos y Alcantarillados (INAA)	approved 6/8/98		Tipitapa Power Company
Wastewater Discharge Pipeline ROW Permit	Ministerio de Construccion y Transporte (MCT)	Approved 7/15/98		Tipitapa Power Company
Stack Construction Letter of no Objection	Direccion General de Aeronautica Civil (MCT)	pending	September, 1998	Tipitapa Power Company
Civil Work Construction Approval	Municipality of Tipitapa	approved		Power Construction Company
Use of Roads for Transportation Oversize Equipment	Direccion Nacional de Transporte (MCT)	approved		Power Construction Company

- 3.26 The *Alcaldía de Tipitapa* has authorized the company to construct the plant based on the Aindustrial use≡ condition of the plot of land selected. This authorization was given even though the corresponding *Plan Regulador* has still not been officially finalized and approved (the Municipality is still in the preliminary stages of establishing development plans and land planning programs, with support of the *Instituto Nicaragüense de Estudios Territoriales*).

#### 4. ENVIRONMENTAL AND SOCIAL CONDITIONS

##### A. Environmental

- 4.1 The Tipitapa Power Plant is located approximately 2.5 km south of the town of Tipitapa and 19 km east of Managua. The 4.1 hectares site along the east side of the Old Highway to Tipitapa is adjacent to ENEL's 138 kV Tipitapa substation. The area is relatively flat, ranging in elevation from 56 to 60 meters above sea level (msl)
- 4.2 The community of *San Rafael*, located 0.5 km south of the site, is the closest residential area. Areas to the north and east of the site are primarily open fields or agricultural areas with some scattered houses. The closest industrial facilities to the site are located 4.5 km northeast of the site (including *Química Borden*, a tobacco company, and a furniture factory). The *El Trapiche* recreational area is located 0.5 km west of the site.
- 4.3 Climate: This area of the country close to the Pacific Ocean, is a tropical savanna with dry periods between January and April. The rainy season starts in May and lasts until October (average monthly precipitation in these months varies from 153 to 214 millimeters). During the dry season the average precipitation is 5 millimeters per month. The annual average precipitation is 1,112 millimeters. Temperature averages are similar during the whole year, ranging from 25 to 28 °C. Average maximum wind speeds in the area of the proposed Tipitapa plant is approximately 3.5 meters per second. January and March are the months of most intense wind, which comes mainly from the east and then from the northeast. Days of calm are also significant during the months of May and June when up to 34 percent of the time the wind is primarily calm.
- 4.4 Air Quality: In December 1997, as part of the EIA preparation, an ambient air quality assessment was performed to establish baseline conditions. Ambient air quality was monitored at two locations: one west or downwind of the site (station 1) and one east or upwind of the site (station 2). At each station, 24-hour composite samples were collected for PM<sub>10</sub>, SO<sub>2</sub>, and nitrogen dioxide (NO<sub>2</sub>). Monitoring results are presented below and indicate that ambient air concentrations of PM<sub>10</sub>, SO<sub>2</sub>, and NO<sub>2</sub> in the vicinity of the site are well below ambient air quality values presented in the World Bank Pollution Prevention Guidelines.

#### Results of ambient air quality monitoring

Parameter	Unit	Station 1 24 hour	Station 2 24 hour	World Bank Guidelines	World Bank Guidelines
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		concentration	concentration	(1995)	(1997)
PM10	Φg/m;	33	14	110	150
SO2	Φg/m;	24	16	125	150
NO2	Φg/m;	17	10	150	150

- 4.5 There are no major sources of air emission near the project site (closest industry is *Química Borden* located approximately 4.5 km northeast of the site). The nearest natural source of air emission is the *Masaya* volcano, located twenty kilometers south of the site. According to the EIA, the volcano=s emissions affect the air quality of the whole country.
- 4.6 Surface Water: The largest body of surface water in the regional area is Lake Nicaragua, followed by Lake Managua. In the *Tipitapa* district, the *Tipitapa* River is the largest river and connects both Lake Managua and Lake Nicaragua. The *Tipitapa* River basin covers approximately 183 km<sup>5</sup> and flows into Lake Nicaragua. The *La Mocuana* River, a tributary of the *Tipitapa* River, is located approximately one kilometer south from the project site. The width of the river varies from three to five meters wide, has an average slope of 0.3 percent, with fairly constant flow (estimated average flow of 371 lpm). The basin of *La Mocuana* River covers an area of approximately 16 km<sup>5</sup> (total length of river is 4 km). Another river near the project site is the *El Trapiche*, which originates from the hot springs called *El Trapiche* (approximately 250 meters west of the plant site). The river has been channeled and dammed for recreational purposes and is approximately 1.1 km long. At the hot springs know as *Panamá*, *La Mocuana* and *El Trapiche* form the *Escondido* River, which flows into Lake Managua. These rivers are permanent waterways. Surface waters in the vicinity of the project site are used primarily to irrigate arable land near *La Mocuana* River and, secondarily, for laundry purposes by the local residents. The plant site has no permanent surface waters.
- 4.7 The quality of water of both *La Mocuana* and *El Trapiche* rivers were analyzed as part of the EIA. In November 1997, samples were collected and analyzed at three locations: *La Mocuana* River upstream from where the treated wastewater from the plant is proposed to be discharged (Station 1); *La Mocuana* River downstream from the proposed project discharge (Station 2); and *El Trapiche* River at its source (Station 3). The results of this water quality sampling are summarized in the table below.

**Results of water quality sampling**

				MARENA Wastewater	World Bank
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Parameter	Station 1	Station 2	Station 3	discharge limits	Guidelines
pH, units	8.10	8.05	7.96	6 to 9	6 to 9
Conductivity, $\Phi$ ohms/cm	892	895	526	---	---
Temperature, N C	26.6	27.0	27.5	50	---
COD, mg/l	85	29	28	200	---
BOD, mg/l	7.76	4.72	3.52	90	50
Copper, mg/l	ND	0.00624	0.00552	0.8	---
Iron, mg/l	0.334	0.416	0.103	---	---
Zinc, mg/l	ND	0.03066	0.03558	2	---
Oil and grease, mg/l	2	5	4	20	20
Suspended solids, mg/l	5	6	ND	60	50
Total phosphorus, mg/l	0.0385	0.1483	0.0604	5	---
Hydrocarbons, mg/l	ND	ND	ND	2	---
PCB, ppb	ND	ND	ND	Absent	---

Notes: COD= chemical oxygen demand  
BOD= biochemical oxygen demand  
mg/l= milligrams per liter  
ND= not detected

ppb= parts per billion  
PCB= polychlorinated biphenyl  
ohms/cm= microhms per centimeter

- 4.8 Ground water: The plant site is located above the Managua subterranean basin. The depth of ground water in the region is estimated to range from 2 to 125 meters below ground surface, with shallow depths located near the coast of Lake Managua and the greater depths at the foot of the Pacific Range foothills; the depth at the project site is approximately 5 to 10 meters. The estimated base of the aquifer is approximately 120 to 200 meters in depth and transmissibility values ranging from 100 to 7,270 m<sup>2</sup>/day. In the town of *San Rafael*, located at approximately 0.5 km south from the project site, there is a 61-meter deep supply well with a static water level of approximately 12 meters. The Managua subterranean basin is exploited by INAA in order to provide drinking water for the regional population of the area. Near the project site there are some shallow ground water wells used for domestic water supply (although most houses are connected to local water supply system) and for livestock purposes. As part of the EIA, only existing available information was available since INAA did not allow the drilling and testing of ground water wells prior to the EIA approval. Thus the project Sponsors have performed, and are continuing to perform, specific ground water investigations to confirm the availability of ground water and any potential impacts on existing ground water uses.

- 4.9 Geology: As part of the EIA a detailed analysis of the geological, seismic and structural conditions of the area where the future plant is to be built. The analysis determined that the risk level is considered acceptable for the community and the buildings.
- 4.10 The plant's site is 0.4 kilometers northeast from the rising block of the *Cofradía* fault. According to the records, in the plants site area, no earthquakes took place between 1975 and 1982 (date of the available data base records). The Company concluded that the probability of earthquakes in the research area is unknown. The *Cofradía* system has seldom been studied (the closest seismograph is 20 km away).
- 4.11 There are volcanic hazards related to the closeness of the *Masaya* volcano. According to the assessment, hazards due to volcanic activity vary and occur at long intervals, concluding that, at present, the area is in a transition period between flows of lava corresponding to 164 years. It is estimated that the next episode will take place much later than the life of the plant=s operation.
- 4.12 The studied area is not subject to other geological risks such as the fissuring of the ground caused by vertical displacements or problems of structure settling due to the water-bearing stratum levels.
- 4.13 Environmental resources: The plant site has been significantly modified in the past due to the presence of human activities and is presently an abandoned agricultural site. At the beginning of construction, it was totally invaded by herbaceous plants that grew 30 to 50 centimeters high, such as buttonwood, *ron-ron*, yellow sage and *mozote*. A sorghum plantation, which occupies an area of 26 acres is located south of the site. In *San Rafael*, each residence has a yard planted with a high density and broad variety of arboreal species. Wild flowers are found in some uninhabited yards and alongside some poorly kept streets.
- 4.14 The forest vegetation in the area consists of lower forests, which develop in warm semi-humid zones. Apart from fauna and flora utilized for agricultural exploitation, there hardly exist native species of local economic value. However, there is exploitation of some trees in the area used as firewood, and turtle eggs and fish from the estuaries are used for consumption by local people. The presence of planted trees, spontaneous shrubby vegetation and birds associated to it are the main elements of the local landscape. There are different birds species, cattle, and wildlife including black iguana, gray fox, Mexican opossum and pollinating bats.
- 4.15 Based on bibliographic compilations and observations at the site, the EIA concluded that in the project area there are no endemic, threatened or endangered species, which require to be protected for their preservation.

## **B. Social and Economic**

- 4.16 The *Tipitapa* Municipality belongs to Managua Department. Its main physical, demographic



and social features are the following:

- X Extension: 973 km<sup>5</sup>
- X Municipal Head: *Tipitapa*
- X Total Population: 81,106 inhabitants (1995 National Census)
- X Annual Growing Rate: 5.8%
- X Urban Population: 47,779 inhabitants.
- X Rural Population: 33,327 inhabitants.
- X Population Density: 83 inhabitants per square kilometer
- X Eight towns in the urban sector, San Rafael being one of them, next to the project site.
- X *Tipitapa* housing: 14,321
- X Employment: Primarily agricultural. Mainly: sugar cane
- X Number of important industrial plants: 6
- X Health Centers: 11
- X Local utilities: Water (51.6% coverage), without sewerage, electric energy (32% coverage), poor level of street=s pavement, telephones (150 subscribers), poor public lighting and garbage collection.

- 4.17 The project=s direct influence will be on the town of *San Rafael*. *San Rafael* consists of approximately 600 irregularly spaced houses and approximately 3,600 people. There are no paved roads or waste water collection (sewers). Approximately 90% of the local population is supplied with drinking water, although 30% still utilize their own ground water wells. There is no anticipated future growth in the town/neighborhood since there is no available land (i.e., surrounding land used for non-urban). A survey performed as part of the EIA identified that approximately 60% of the population works in services, 20% in trading and 6% in industry, with an average salary of 1,700 cordobas per month (approximately US\$170). The survey also determined that the majority of the population uses firewood to cook. Based upon the existing information, the social and economic level of the population is defined as low.
- 4.18 There is no evidence of archeological or cultural resources in the area. Also, from the previous use of land of the project site (agricultural) there is no evidence of archeological or cultural resources in the site itself.
- 4.19 There are no industrial facilities in the immediate area of the project site, with the closest industrial facilities being 4.5 km northeast of the site (including *Química Borden*, a tobacco company, and a furniture factory). In town of *Tipitapa* there is one industrial metalworking facility, two poultry operations, one cooking oil producer, one rice producer, and one chemical facility.

- 4.20 Regarding traffic,<sup>1</sup> since fuel will be transported by the supplier using existing roads, two possible routes from Puerto Sandino have been considered. The first travels along the New Highway to León for approximately 99 km until reaching the plant site. The second one travels along the Old Highway to León for approximately 87 km until reaching the plant site. The roads are paved and they have variable widths sufficient for two lanes of traffic. However, the roads lack proper maintenance, the roadsides are deteriorating (mostly in the rainy season), and there is no traffic control. Traffic on the Old Highway to León, adjacent to the plant, reaches 11,550 passenger and 4,320 cargo vehicles per day.

## 5. ENVIRONMENTAL AND SOCIAL IMPACTS

### A. Construction Phase

- 5.1 The principal potential negative environmental impacts that may occur during the construction stage include: impacts on air quality due to dust generation and emissions from construction vehicles, spills of petroleum products and chemicals, increased noise levels, soil erosion and non-point pollution of surrounding surface water resources, increased noise, waste disposal (construction wastes, petroleum products, sanitary waste water), loss of small area of land use (agriculture), and limited impact on local flora and fauna. These impacts are primarily all temporary and reversible.
- 5.2 The construction phase will result in the following potential principal socio-economic negative impacts: temporary increase in population due to construction workers and associated impacts on services, utilities, etc.; increased noise in the immediate areas; and impacts associated with increased traffic associated with movement of construction vehicles and workers. There are no historical or archeological sites that will be impact related to the project. No resettlement or expropriation is required associated with the project.

### B. Operation Phase

#### B.1 Environmental

- 5.3 The three principal potential environmental impacts associated with the operation of the Tipitapa power plant project are related to air emissions, water supply, and waste water discharges. The magnitude and effect of these impacts are described below. Other minor environmental impacts associated with the project operation include: noise, waste management (e.g., storage and disposal of solid sanitary waste, waste oil/petroleum products), accidental spills or releases, and visual change to local landscape.

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<sup>1</sup> The FSA requires ESSO to deliver the fuel to the plant site.

- 5.4 Air Emissions. The generation of electric energy by the plant will involve primarily the combustion of Bunker C (Fuel Oil No. 6) and result in the emission of various gaseous pollutants (principally sulfur dioxide (SO<sub>2</sub>), nitrogen oxides (NO<sub>x</sub>) and particulate matter (PM)). The resultant impact on air quality will depend on the combustion system utilized (equipment), the fuel sulfur level (specified to the supplier) and the dispersion provided by the stacks height.
- 1.5 Air quality/emission modeling was performed as part of the EIA. The model used was the ISCST3 model<sup>2</sup> which predicts ambient air quality based upon plant design characteristics (e.g., stack design<sup>3</sup>, emission rates; refer to table below) and meteorological parameters (e.g., wind direction, wind speed, atmospheric stability class, ambient temperature and mixing heights; meteorological data used was from years 1976 and 1977 for Managua and San Jose de Costa Rica). The model was used with the following site parameters: rural classification (dispersion coefficients, mixing height), simple terrain, regulatory default option, and complex downwash analysis. The model incorporated background ambient air quality levels based upon the ambient air quality results from the EIA and did not include any other major emission sources since none are actually present. The model input data for the plant's exhaust stack are summarized in the table below:

**Summary of model input source characteristics**

Parameter	Units	Tipitapa Power Plant (Merged Stack)
Stack height	meters	32.0
Stack diameter	meters	2.68
Stack exit speed	m/s	32.0
Emission rates		
SO <sub>2</sub>	g/s	193.6
NO <sub>x</sub>	g/s	220.0
PM	g/s	7.7
Temperature	EK	580.8

- 5.6 The results from the application of the ISCST3 are summarized below, and represent the

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<sup>2</sup> This is a simplified version of the EPA's 1996 ISC3 model, which is a steady-state Gaussian plume model that can be used to assess potential air quality impacts from a wide variety of sources

<sup>3</sup> For dispersion modeling purposes, the five physical diesel engine exhaust stacks, which are located adjacent to each other in a cluster, were merged into one equivalent stack.

maximum concentrations estimated from all model calculations (i.e., maximum 1-hour concentration estimated over a year based model calculations using the actual hourly meteorological conditions):

#### Summary of ISCST3 model results

Parameter	PM10 concentration (F g/m;)			SO2 concentration (F g/m;)			NO2 concentration (F g/m;)		
	1 hour	24 hour	Annual	1 hour	24 hour	Annual	1 hour	24 hour	Annual
<b>Project impact (Year 1976)</b>	NA	1.6	0.3	126.0	39.5	7.4	143.1	44.9	8.4
<b>Project impact (Year 1977)</b>	NA	1.1	0.2	121.4	28.5	5.0	137.9	32.3	5.7
<b>Background</b>	NA	33.0	6.6	60.0	24.0	4.8	42.5	17.0	3.4
<b>Total impact; 2 year max.</b>	NA	34.6	6.9	186.0	63.5	12.2	182.6	61.9	11.8
<b>World Bank guideline, 1995</b>	None	110.0	70.0	350.0	125.0	50.0	400.0	150.0	None
<b>World Bank guideline, 1997</b>	NA	150.0	50.0	NA	150.0	50.0	NA	150.0	100.0
<b>EPA standard</b>	None	150.0	50.0	None	365.0	80.0	None	None	100.0

Note: Annual and 1 hour background estimated by multiplying 24-hour background value by 0.2 and 2.5 respectively.

- 5.7 The model results show that the estimated maximum ambient air impacts of SO<sub>2</sub>, NO<sub>x</sub>, and PM<sub>10</sub>, for all averaging times (1 hour, 24 hour, annual), due to emissions from the Tipitapa Power Plant should be well below the World Bank guidelines for ambient air quality and the U.S. Environmental Protection Agency national ambient air quality standards. In addition, the stack emission rates for the plant (1,760 mg/Nm<sup>3</sup> SO<sub>x</sub>, 2,000 mg/Nm<sup>3</sup> NO<sub>x</sub>, 70.2 mg/Nm<sup>3</sup> of PM) will be less than the World Bank guidelines for stack emissions for thermal power plants. The estimated maximum 24-hour average and annual average SO<sub>2</sub>, NO<sub>x</sub>, and PM<sub>10</sub> impacts are projected to occur between 5,000 to 8,000 meters west of the site, respectively, and the maximum 1-hour SO<sub>2</sub>, and NO<sub>2</sub> impacts are projected to occur approximately 1,500 west of the site.
- 5.8 Water Supply. Approximately 2,270 liters per minute (lpm) of water will be supplied to the plant from two new on-site ground water wells, primarily for cooling water purposes (2,200 lpm). The wells will be drilled to an overall depth of approximately 120 meters below ground surface. An initial ground water investigation was performed in April 1998 and indicated that the ground water aquifer had sufficient available resources to meet the plants water supply needs and would not result in significant impacts on surrounding ground water uses/users. Based on this investigation, INAA issued a Groundwater Withdrawal Permit in June 1998. As part of the Environmental License, MARENA has requested the company to explore alternatives sources for the plant water supply.
- 5.9 Waste Water. Waste water from the facility will be primary cooling water, with limited amounts of sanitary and industrial waste water and storm water runoff. Cooling and treated industrial waste water (sedimentation, neutralization and other chemical treatments as necessary) will be discharged from the plant via a 1,020 meter pipeline constructed along the

east side of the Old Highway to Tipitapa, into the *La Mocuana* River. The estimated discharge volume will be between 511 to 984 lpm with an average temperature of approximately 34°C, comprised of approximately 50 percent cooling and 50 percent industrial waste water. Domestic waste water will be disposed in an on-site septic system. Based upon mathematical modeling performed as part of the EIA, it was confirmed that the waste water discharges will comply with applicable Nicaraguan Ministry of Natural Resources and the Environment (*Ministerio del Ambiente y Recursos Naturales*, MARENA) requirements and the World Bank guidelines new thermal power plants (Pollution Prevention Handbook, September 1997). Storm water runoff which may be contaminated (e.g., from the fuel unloading, fuel storage, and other equipment areas) will be collected and treated (oil water separator) prior to discharge.

## **B.2 Social**

- 5.10 The principal potential negative social impact associated with the project, is the indirect (in the sense that the impact is not the direct responsibility of the project sponsor) impact related to transportation of fuel to the project site (e.g., increased noise, traffic, potential accidents). The fuel to be supplied by ESSO by truck from a ESSO terminal near Managua (approximately 25 kilometers from the site). The fuel supply will require a maximum of 15 trucks per day which will travel at night from near Managua to the site (as specifically required by MARENA). The roads are paved and have widths sufficient for two lanes of traffic and no significant improvements to existing roads will be required associated with the Tipitapa project

## **C. Positive Impacts/Benefits**

- 5.11 In addition to adding electric energy generation to the Nicaraguan system that is facing supply problems, the plant's construction will cause beneficial impacts by providing job opportunities, especially during the construction stage. This impact will directly benefit the neighboring areas such as Tipitapa and Managua. In addition, the project construction is expected to contribute to the development of other related activities such as the sale of building materials, the transportation of staff to and from the plant, and others. During operation phase, other sectors that will benefit include services (maintenance, safety, monitoring, transport and waste disposal) and goods supply (lubricant oils, spare parts in general, etc.). The project is expected to have a positive impact in the use and occupation of land in the area by attracting other forms of investments and the enhance an efficient development of the industrial area of Tipitapa.

## 6. ENVIRONMENTAL AND SOCIAL MITIGATION AND MONITORING MEASURES

The environmental and social mitigation measures and monitoring programs for the project, which were developed and presented in detail in the project EIA as part of the Environmental Management Plan, are summarized in sections VI.A and VI.B, respectively (see section VI.C for description of other components of Environmental Management Plan).

### A. Mitigation Measures

#### A.1 Construction Phase

6.1 The following are the principal mitigation measures to be implemented during the construction phase of the project:

- X Spray with water, as needed, to control fugitive dust.
- X Maintenance of vehicles and equipment in good working order.
- X Implement appropriate erosion and sedimentation controls to minimize sediment transport (e.g., scheduling of activities, soil compaction, silt fences or other measure to minimize transport, etc.).
- X Immediate actions implemented to contain and cleanup accidental spills.
- X Foundations and facilities designed in accordance with earthquake zone ratings.
- X Implement appropriated measures and areas for temporary storage of petroleum products and any chemicals.
- X Design and implement appropriate waste management procedures, including proper collection and storage of waste, disposal of sanitary and construction related wastes in accordance with local requirements (note: some construction waste, such as wood, carton, metal, will be recycled), disposal or recycling of waste petroleum products.
- X Install portable waste water latrines.
- X Implement construction warnings/controls along highway and site area.
- X Construction activities to occur only during day-time hours.
- X Implement worker health and safety procedures and necessary equipment.
- X Implement worker training program.
- X Implement measures to record and recover any cultural resources that may be found during construction.

#### A.2 Operation Phase

6.2 The principal proposed mitigation measures associated with the operation of the project include:

- X SO<sub>x</sub> controlled by the use of fuel oil with a maximum sulfur content of 3 percent by

weight.

- X NOx controlled by use of diesel motors (Wartsila 18V38) with low-NOx combustion design.
- X PM controlled by the use of fuel oil with maximum ash content of 0.2 percent by weight.
- X Design of stack heights to ensure proper dispersion of air pollutants.
- X Design of ground water wells and water withdrawal volumes to maintain a sustainable and efficient use of the resource.
- X Install cooling towers to reduce temperature of cooling water.
- X Install a waste water treatment plant for industrial waste water.
- X Install water/oil separation system for storm water runoff from potential contaminated areas (e.g., fuel loading, storage, etc.).
- X Install spill retaining system in fuel tank storage area.
- X Install noise silencers and acoustic absorbing material associated with turbines.
- X Implement waste management program, including specifically for solid wastes and for petroleum and any hazardous wastes.
- X Implement work training program.
- X Implement training program for truck drivers related to highway safety and contingency plans.
- X Design and implement contingency and safety plans and equipment based upon identification of potential risks (see section VI.C).
- X Install fire protection and response system (fireplugs network, extinguishers, alarm system).
- X Landscape treatment of plant surroundings.

## **B. Monitoring Program**

6.3 During project construction, the following monitoring will be performed:

- X Monitoring of the *La Mocuana* River water quality (various parameters) on three different dates at two locations (upstream and downstream) in order to evaluate potential construction related impacts.
- X Groundwater quality in the on-site wells will be monitored on a quarterly.
- X Pump tests or other appropriate ground water investigations will be conducted, as necessary, to further confirm design operating conditions and the ability of the aquifer to meet the plants requirements.

6.4 During the operation stage, monitoring will be performed for air quality, surface and ground water, noise and biological indicator species (described below). All monitoring results will be routinely sent to MARENA and INE.

6.5 Air quality. Ambient air quality monitoring of combustion parameters (sulfur dioxide, nitrogen oxides and particulate material) will be done quarterly. Carbon monoxide will be monitored yearly (MARENA stated that monitoring CO is needed to measure traffic

incidence). Two control stations will be used for ambient air monitoring, one west or downwind from the plant, and the other one east or upwind from the site. At each station, continuous air samples will be collected for a 24-hour period using appropriate methods and equipment.

- 6.6 Waste water. Waste water to be discharged into the *La Mocuana* River will be monitored quarterly for the parameters listed in Decree No. 33-95. Water temperature will be monitored randomly on a weekly basis.
- 6.7 Surface water. Water quality will be tested quarterly in two sampling stations in the *La Mocuana* River (upstream and downstream discharge) for various parameters.
- 6.8 Ground water. Quarterly ground water samples from the two on-site wells will be collected and analyzed for a set of indicative parameters.
- 6.9 Noise. After initiation of operations, noise levels will be monitored within the plant's boundaries and among potential recipients (neighbors).
- 6.10 Biological Monitoring. Biological indicators in the *La Mocuana* River will be monitored (aquatic macro invertebrates) at two locations (note: base line sampling was already performed).

#### **C. Contingency Plan and Procedures**

- 6.11 A project Contingency Plan was developed based upon the potential risks identified in the EIA. The Contingency Plan provides procedures to minimize or avoid accidents, damage or cause the interruption of the plant's operation during an emergency situation. The Contingency Plan provides procedures for the following specific emergency situations: fire or explosion; safety risks; bomb threat; medical emergencies and accidents; strong winds, tropical or electric storms; torrential rains and floods; earthquakes; volcanic eruptions; oil spills or leakage; and dangerous substances spills or leakage.
- 6.12 The EIA identified the following three most significant operational risks:
  - X Explosion or fire of fuel tanks and the resultant risk of damage to workers, plant facilities, and to a lesser extent the surrounding population and the environment.
  - X Leakage or spill of fuel oil in the plant which could result in soil and water (ground and surface) contamination.
  - X Accidental spills of chemicals used for water treatment, lubricant oils, etc which would result in soil and water (ground and surface) contamination.

#### **D. Costs, Schedule and Responsibilities**



- 6.13 The estimated annual cost for implementation of the project Environmental Management Plan is approximately 60,000 U.S. Dollars. The Environmental Management Plan, which was part of the project EIA, includes (i) an Environmental Monitoring Plan (see section VI.B); (ii) a Maintenance and Control Management Plan (which includes scheduled inspections and maintenance of plant equipment during operation and other actions to ensure implementation of environmental measures); (iii) a Hydrocarbon Management Plan (which includes measuring for controlling, containing and cleaning up hydrocarbons in the plant, and emergency response procedures, mentioned in section VI.A); and (iv) a Personnel Training Plan (which includes training in safety areas, medical emergencies, fire emergencies, special waste handling and also training in some aspects of the Contingency Plan; mentioned in sections VI.A and VI.C). This estimated cost does not include costs related to the implementation of some mitigative measures, which are part of the construction and normal operation of the plant.
- 6.14 The environmental and social mitigation measures and monitoring programs will be implemented as follows: those related to construction during the first year, and those related to operations during each subsequent year.
- 6.15 The project sponsor is responsible for the implementation for all measures and activities specified in sections VI.A to VI.C. In particular, the plant manager has been designated responsible for the adequate implementation. The plant manager will be supported by personnel with the following designated responsibilities: environment health and safety, emergency response coordinator, and training coordinator. Specific actions to ensure adequate and effective implementation are included in the Maintenance and Control Management Plan and the Personnel Training Plan (part of the Environmental Management Plan).

## 7. PUBLIC CONSULTATION

- 7.1 As part of the preparation of the project Environmental Impact Assessment, various persons/entities (e.g., different public agencies, the head of the local government (*Alcaldía*), national police, traffic authorities, officers from the Department of Tourism, INAA, the School of Engineering, etc.) were directly contacted. The purpose of the interviews was to understand the applicable environmental requirements (e.g., laws, regulations), the necessary studies and permit applications (e.g., EIA, Environmental Permit, etc.), the environmental and social characteristics of the project site area, and the opinion of qualified participants with respect to the project.
- 7.2 In addition, a specific survey was performed of approximately 150 people from the neighboring district of *San Rafael* in order to obtain information on the socio-demographic characteristics of the population and their opinions related to the project. Information on the project was provided, including specifically the potential environmental and social impacts that could result from the plant's construction and operations (e.g., increased noise and

traffic, potential risks of water and air pollution, etc.). For those interviewed, the possibilities of new sources of employment were considered much more important than any potential negative environmental or social effect.

- 7.3 A project specific public hearing was convened by MARENA as required by Decree 45-94 in order to obtain the project Environmental Permit. An announcement of the meeting was made in January 1998 in the local newspapers and also by vehicles with loudspeakers which drove around the *San Rafael* neighborhood. The public hearing took place in Tipitapa on January 23, 1998, with approximately 30 people attending the meeting. During the meeting representatives of TPC and the company that performed the EIA explained the nature of the project, the environmental impacts and potential risks, and the mitigative measures. The audience asked few questions and expressed no objections. The EIA was made available to the public at the offices of MARENA in January 1998.

## 8. RECOMMENDATIONS

- 8.1 The Bank will require the Tipitapa Power Company (TPC) to comply with the following related to the Tipitapa Power Plant Project: (I) all the applicable environmental health and safety Nicaraguan regulatory requirements; (ii) all necessary Nicaraguan environmental, health and safety permits, authorizations and licences that apply to this project, including without limitation the Environmental Permit (Resolution No. 005-98 issued by MARENA) and Groundwater Well Drilling and Withdrawal Permits (issued by INAA); (iii) all the environmental, social, health and safety requirements specified in the PPA of December 19, 1997; (iv) the World Bank Guidelines for Thermal Power Plants (Pollution Prevention Handbook, September 1997); and (v) all environmental and social mitigation measures, monitoring programs, and actions identified in the project Environmental Impact Assessment (dated February 1998), including without limitation all components of the Environmental Monitoring Plan and the Contingency Plan.
- 8.2 Prior to financial closing, the following conditions are required to be fulfilled by the Tipitapa Power Company (TPC):
- 1) Present a proposed Project Supervision Plan, for Bank approval, which will include the specific methods (e.g., use of independent environmental consultants, environmental health and safety inspections and audits, etc.) to be implemented in order to ensure that the environmental and social components during project operation are properly implemented by all entities.
  - 2) Provide information to completely verify that the use of ground water by the plant will not significantly affect any existing ground water uses/users or the long-term sustainability of the aquifer system.

8.3 Prior to first disbursement, the following conditions are required to be fulfilled by TPC:

- 1) Provide a description of the planned environmental and social monitoring programs for the operation of the plant, including a cost estimate and time schedule for implementing these monitoring programs, including without limitation routine stack emission monitoring for NO<sub>x</sub>, SO<sub>x</sub>, and PM, site meteorological monitoring, continuous temperature monitoring of waste water effluent, monitoring of waste water effluent and surface water for all parameters in Nicaraguan Decree 33-95 and World Bank Guidelines for new thermal power plants, and noise monitoring on various occasions (dates).
- 1) Provide a description of the planned environmental and social mitigation measures for the operation of the plant, including a cost estimate and schedule for implementing these mitigation measures, including without limitation specific measures for disposal of waste petroleum and hazardous wastes, measures for disposal of non-hazardous solid waste in compliance with all Nicaraguan regulations, contract with ESSO for fuel transportation which requires TPC liability protection from accidental spills or releases during fuel transportation and unloading and requires fuel trucks to be adequately equipped with necessary safety and spill response equipment and the drivers to be properly trained.
- 2) Provide a detailed Contingency Plan for the plant operation and written assurance that sufficient resources will be made available for the implementation of the plan.
- 3) Provide evidence of governmental issuance of the Stack Construction Letter of No Objection and the Facility Inspection Approval.
- 4) Provide a proposal, subject to IDB approval, to completely evaluate and verify the potential effect of the plant's air emissions, which should include, as a minimum, implementation of a local meteorological station and subsequent additional air dispersion modeling to include more complete representation of meteorological conditions (e.g., local meteorological data, various alternative stabilities, etc.), use of alternative fuels, effect of modeling five chimneys as one chimney, non-normal conditions (e.g., plant operations, meteorological conditions, etc.), and start-up and shut-down conditions.

8.4 After beginning commercial operations and no later than 180 days after start of commercial operations, TPC must submit a report on Environmental and Social Aspects of the Project Construction, and include, at a minimum, the following:

- 1) Certification that all construction related environmental and social requirements (environmental and social loan covenants) were fully implemented and that the project is in material compliance with all environmental and social requirements.
- 1) Description of any changes which occurred during construction which may have had an environmental, social or health and safety effect.
- 2) Description of any known environmental or social liability or any known non-

- compliance with any environmental and social requirement.
  - 2) Copy of any major environmental or social report or document prepared in order to satisfy regulatory requirements, except those already submitted to the Bank.
- 8.5 Prior to last disbursement, the following conditions are required to be fulfilled by the TPC:
  - 1) Certification of compliance with all environmental and social requirements.
  - 2) Description of any non-compliance with any environmental and social requirement and action plan to correct non-compliance.
  - 1) Description of any known environmental and social liability or unforeseen impact or risks.
- 8.6 During the term of the loan, TPC must prepare and submit an Annual Environmental and Social Compliance Report, which will be due on the anniversary of the financial closing date. The report must include, at a minimum, the following:
  - 1) Certification that TPC is complying with all environmental and social requirements;
  - 2) Description of any changes in the construction or operation of the plant which may have an environmental or social material effect, explaining the reasons for such changes and any actions taken to mitigate the environmental and social impacts.
  - 3) Description of any non-compliance with any environmental and social requirement which may have occurred and a description of measures taken to correct the non-compliance.
  - 4) Description of any significant environmental or social problem (such as accident, unplanned event, etc.) and a description of the actions taken to solve the problem and the measures taken to prevent the event from occurring in the future.
  - 1) Description of any contact by a third party (including governmental agency, public, non-governmental organization, TPC employee, etc.) regarding environmental, social, or health and safety.
  - 2) Description of planned environmental and social related activities to be performed during the next year, including estimated cost, schedule, and responsibility.
  - 3) Copy of any environmental and social document or report written to comply with governmental regulatory requirements.
- 8.7 During the term of the loan, TPC must comply with the following requirements:
  - 1) Consult with the Bank before approving and implementing any change to the project=s operations which will result in a material environmental or social impact.
  - 2) Provide written notification, within a period of no more than 30 days, of a non-compliance with any environmental and social requirement or an environmental or social problem or event, and the measures taken to correct and/or respond to the non-compliance or problem.
  - 1) Only use fuels which have a sulfur content of less than 3 percent by weight and ash

content of less than 0.2 percent by weight.

- 2) Implement an Environmental Management System during project operation which is consistent with the principles of ISO 14000/14001.
- 3) Establish and implement procedures for regular consultation with the local population related to environmental and social aspects of the project.